REMARKS

Status of Claims

Claims 1-7 are pending in the application. The claims have been amended to address the formalities rejections raised by the Examiner and discussed below, and to recite that the projection is formed to a height to form a gap sufficient to prevent explosive vaporization upon welding together of sheets, as disclosed in the abstract and paragraph [0004] of the specification as published.

Claims 8-9 were previously cancelled.

New claim 10 is newly added to claim a preferred embodiment of the invention as recited in paragraph [0013] of the specification as published.

Claim Rejections - 35 USC § 112

Claims 1-7 as amended are rejected under 35 U.S.C. §112, second paragraph.

In response to the rejection based on insufficient antecedent basis for "the laser beam facing surface" Applicants have carefully amended the claims to provide antecedent basis.

In response to the rejection based on lack of clear definition of the term "the region", Applicants delete this unnecessary term.

In response to the requirement to recite positive steps, the claims have been amended. The nexus of the invention is in generating of the topographical change protruding from the surface by directing the laser beam onto the sheet and guiding the laser beam to describe a narrowing spiral.

In response to the rejection for insufficient antecedent basis for "the focal area" in claim 2, Applicants amend claim 2 to provide antecedent basis.

In response to the indefiniteness of the recitation "wherein said melting through is controlled by pre-specifying the processing time or by providing a penetration sensor which regulates the laser machining time", Applicants amend claim 7 for clarity based on paragraph [0013] of the specification as published. The claim is intended to specify two steps – a first step of applying laser energy to cause formation of a protrusion on the side of sheet opposite to the laser by melting through, and a second step of halting the laser either (a) upon elapse of a predetermined amount of time or (b) upon detection of the formation of a protrusion. It is submitted that this alternative recitation is proper, and that the claim recites positive steps.

Withdrawal of the rejections is respectfully requested.

Claim Rejections - 35 USC § 102

Claims 1, 3-6 rejected under 35 U.S.C. §102(b) as being anticipated by FUJIMOTO et al (JP 2002-178178 A cited by applicant) as evidenced by Dunsky et al (US 2001/0045419).

Applicants respectfully traverse in view of the claims as amended.

The Examiner first indicates that Fujimoto et al teach a laser lap welding method in which a protrusion 2a is formed, by melting, on the surface of sheet 2 facing away from laser 1.

However, as Fujimoto et al teach that the penetration depth of the irradiation is 0.60 to 0.95 of the thickness of the material, it follows that the material is not melted through on the side facing away from the laser. See Drawing 1. Thus Fujoimoto does not meet the requirement of ***melting through*** as set forth in claims 1, 3 (and 7).

Further, Fujimoto et al do not teach directing a laser beam onto the sheet and guiding the laser beam to describe ***a narrowing spiral.*** Fujimoto does not teach any movement of the laser while creating the protrusion, especially spiral movement is never mentionend. Fujimote uses a standard laser pulse.

Without melting through and without the narrowing spiral pattern, an insufficient protrusion height is achieved to allow complete escape of vaporized coating material during welding together of two sheets. While the English language abstract of Fujimoto et al mentions a gap, the reason for the gap is not specified, there may be some escape of gasses, but there is no teaching that the gap is of a sufficient height to allow escape of vaporized gasses to the extent to ***prevent explosive vaporization.***

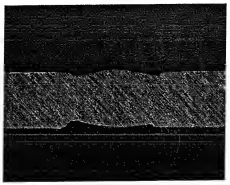
Applicants note that Fujimoto paragraph [0021] teaches protrusions which reach a height of 30 μm. In contrast, the protrusions formed in accordance with the present invention achieve heights of normally 250 μm, a height sufficient to prevent explosive vaporization. In any case it must be appreciated that the superior height of the protrusions of the present invention, directly attributed to the narrowing spiral pattern of the laser, provide a superior gap or spacing to prevent the problem of explosive vaporization.

Thus, the present method "narrowing spiral" showed significantly different results as the standard method "pulsed laser" of Fujimoto et al. Applicants in fact conducted experiments and showed that the present method results in protrusions with a medium hight

of approx. 250 μm while the standard method (Fujimoto et al) results in protrusions with a medium hight of approx. 40 μm.

The following topographic changes were produced, first according to Fujimoto, then according to the present invnetion:

Puls
Standard parameters #1



Topographical Change #	1	2	3	4	5	6	7	8	9	10
Height	0,048	0,049	0,022	0,062	0,058	0,035	0,033	0,026	0,015	0,032

Closing Spiral
(1,0 mm to 0,15 mm, n = 3)
Standard parameters #1

Topographical Change #	1	2	3	4	5	6	7	8	9	10
Height	0,236	0,248	0,257	0,252	0,247	0,236	0,221	0,286	0,246	0,242

The Examiner concedes that Fujimoto et al do not describe a narrowing spiral, but takes the position that this is an ***inherent characteristic*** as shown by Dunsky et al (US 2001/0045419) See Figs. 21, 22, 32. which all show a narrowing spiral weld pattern.)

Applicants respectfully traverse.

The narrowing spiral of the laser path is the most important limitation of the present claims and is responsible for the formation of the superior protrusion. The Examiner has not provided any reason to suspect that Fujimoto ***inherently*** employs such an unconventional technique.

The Examiner's interpretation of Dunsky et al is also without support and is factually in error. Dunsky et al do teach in Fig. 32 a widening spiraling profile 299a for reducing sidewall taper of the hole formed in the sheet. The discussion relating to Fig. 32 concerns ablation (removal) of a wider area in the center of the machining area and less area at the outer spiral section (paragraph [0122]). This has no relevance to the present invention. Dunsky does not teach a ***narrowing*** spiral as already discussed in the prosecution history. This critical fact has been ignored by the Examiner. A widening spiral as in Dansky et al will not get a protrusion but a through hole and without any spiral as in Fujimoto you may get a protrusion but a much lower one as our one.

Further, Dunsky et al relates to laser micromachining and, in particular, to a method and apparatus employing a single pass actuation (SPA) assembly to vary the power density of ultraviolet laser output applied to a target surface during processing of multilayer workpieces having at least two layers with different absorption characteristics in response to ultraviolet light. Dunsky et al form "vias" (holes) or "blind vias" in electronic materials.

Those of ordinary skill would not be able to take the Dunsky discussion associated with Fig. 32 and concerning ablation (removal) of a wider area in the center of the machining area and less area at the outer spiral section (paragraph [0122]) to form a tapering hole, and translate this into forming a topographic projection on one side or the other of a sheet. Thus, the teaching of Dunsky et al does not relate to the present invention and the references can not be combined in the manner proposed by the Examiner.

Dunsky et al nowhere teach forming topographical changes projecting from a surface of a coated metal sheet in preparation for welding. If one were to apply the teaching of Dunsky et al to a coated metal sheet, one would not produce a spacer having the present shape. A

widening spiral as taught by Dunsky et al would not produce the same shape as a decreasing spiral as presently claimed.

Those working in this art would not find within these references suggestion for combining these references, and employing a decreasing spiral technique to form topographical changes projecting from a surface of a sheet, on either the side facing the laser or the side opposite the laser, to make the present invention.

The present invention addresses and solves the problem of (a) speed and (b) gap width. With the present invention, a laser scanner is used for guiding the does not have to be positioned over the individual topographical changes, but can advantageously be guided on an optimized path between the topographical changes. These differences result in very different necessary machining times: using a laser scanner, it is possible to generate 30 suitable topographical changes in about 0.3 seconds; a conventional system requires about 10 times the machining time. This result is not obvious from the cited references.

Accordingly, the rejection is not a proper "inherent anticipation" rejection and withdrawal of the rejection is proper.

Claim Rejections - 35 USC § 103

Claim 2 is rejected under 35 U.S.C. §103(a) as being unpatentable over Fujimoto et al in view of Milewski et al (US Patent No. 5,760,365).

According to the Examiner the teachings of Fujimoto et al have been discussed above, and while Fujimoto et al fails to teach (re claim 2) the method in claim 1 wherein the laser beam is not focused upon the surface, this is obvious over Milewski et al.

Applicants respectfully submit that the patentability of claim 1 has been established above, and that claim 2 is patentable by virtue of it's dependency from claim 1.

Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over Fujimoto as evidence by Dunsky et al (US 2001/0045419) in view of Leong et al (US Patent No. 6,329,635). The Examiner acknowledges that the primary references do not disclose that the melting-through is controlled by pre-specifying a processing time or by providing a penetration sensor which regulates the laser machining time.

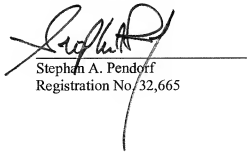
In response, Applicants submit that the Examiner's reliance on Fujimoto et al as evidence by Dunsky et al is would not lead to the present invention for the reasons discussed in detail above (and in particular no decreasing spiral of the laser beam). Accordingly, citing

Leong et al for teaching a method for welding and laser heat treatment monitoring which involves determining depth penetration wherein the machining time can be controlled in term of a calibration curve does not remedy the deficiencies in the primary references.

Accordingly, withdrawal of the rejection and early issuance of the Notice of Allowance is respectfully requested. Should further issues remain, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

The Commissioner is hereby authorized to charge any fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

Respectfully submitted,



Patent Central LLC
1401 Hollywood Blvd.
Hollywood, FL 33020-5237
(954) 922-7315

Stephan A. Pendorf
Registration No. 32,665

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